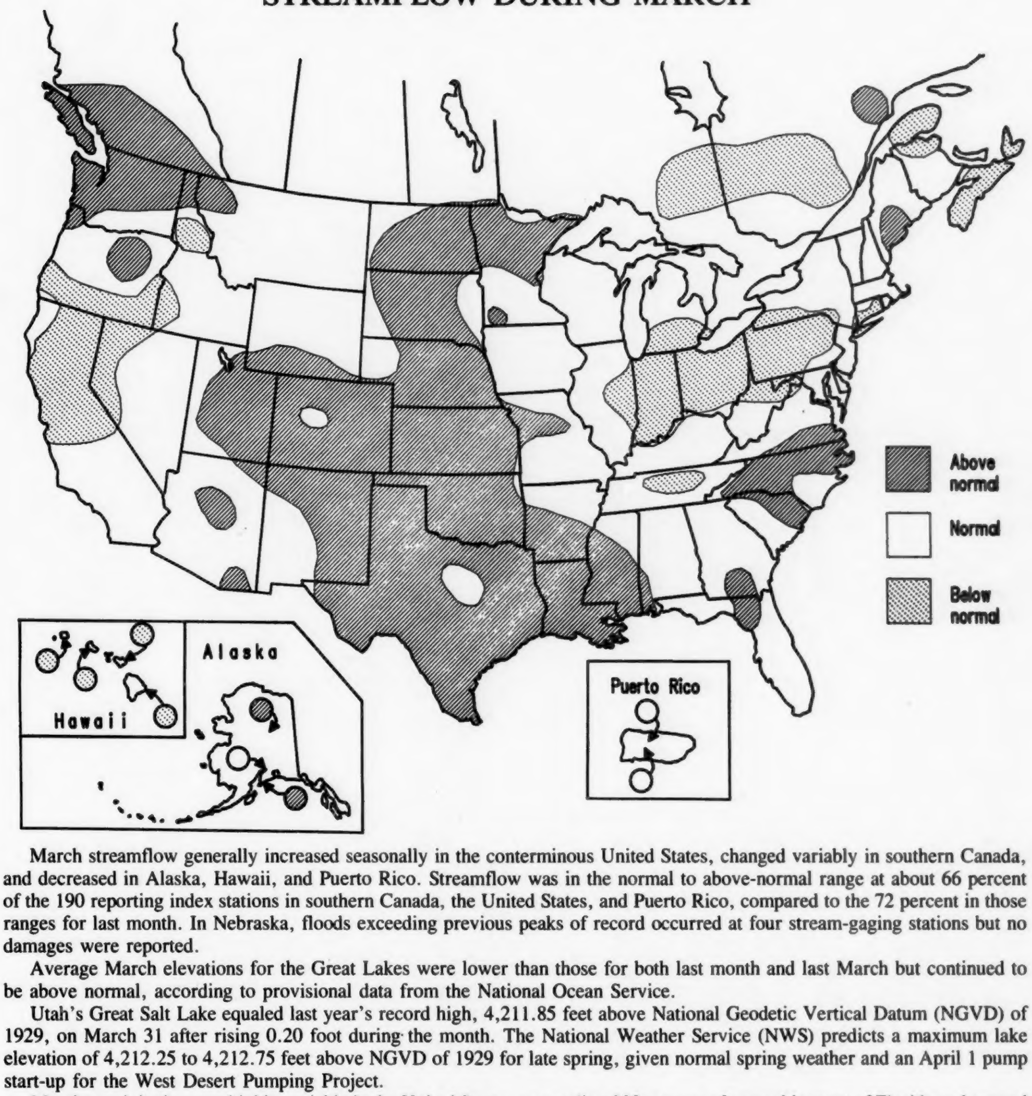
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

MARCH 1987

STREAMFLOW DURING MARCH



March streamflow generally increased seasonally in the conterminous United States, changed variably in southern Canada, and decreased in Alaska, Hawaii, and Puerto Rico. Streamflow was in the normal to above-normal range at about 66 percent of the 190 reporting index stations in southern Canada, the United States, and Puerto Rico, compared to the 72 percent in those ranges for last month. In Nebraska, floods exceeding previous peaks of record occurred at four stream-gaging stations but no damages were reported.

Average March elevations for the Great Lakes were lower than those for both last month and last March but continued to be above normal, according to provisional data from the National Ocean Service.

Utah's Great Salt Lake equaled last year's record high, 4,211.85 feet above National Geodetic Vertical Datum (NGVD) of 1929, on March 31 after rising 0.20 foot during the month. The National Weather Service (NWS) predicts a maximum lake elevation of 4,212.25 to 4,212.75 feet above NGVD of 1929 for late spring, given normal spring weather and an April 1 pump start-up for the West Desert Pumping Project.

March precipitation was highly variable in the United States, exceeeding 200 percent of normal in most of Florida and several areas west of the Mississippi River, but was less than 50 percent of normal in a fairly large contiguous area in the East and several smaller areas in the West, according to provisional data from the NWS.

Contents of 87 percent of reporting reservoirs were near or above average for the end of March, compared with 83 percent for the end of February.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 1,441,500 cubic feet per second during March, 22.1 percent above median, and 46.6 percent above last month's flow.

SURFACE-WATER CONDITIONS DURING MARCH 1987

March streamflow generally decreased in only five areas: in Alaska and Alberta, seasonally; in Hawaii and Ohio, contraseasonally; in Puerto Rico, variably. Flow changed variably in Oregon, Idaho, Texas, Georgia, Virginia, Maryland, Indiana, Ontario, and Quebec. Flow increased seasonally in the rest of southern Canada and the United States except in British Columbia and Washington where flow increased contraseasonally. Streamflow was in the normal to above-normal range at about 66 percent of the 190 reporting index stations in southern Canada, the United States, and Puerto Rico, compared to the 72 percent in those ranges for last month. Both the monthly mean discharge of 314,000 cubic feet per second (cfs) and the maximum daily discharge of 338,000 cfs on the 4th were March maximums of record on the St. Lawrence River at Cornwall, Ontario. New March maximums occurred at four other streamflow index stations (see table on page 4) but no new March minimums occurred. Hydrographs of streamflow at 4 index stations for the 26 months ending March 1987 are shown on page 4. In Nebraska, floods exceeding previous peaks of record occurred at four stream-gaging stations (two with short periods of record) but no damages were reported. South Fork Elkhorn River near Ewing (drainage area 314 square miles) peaked at 6,700 cfs, recurrence interval about 100 years, on March 18, exceeding the June 1947 peak by about 3,300 cfs, and Elkhorn River at Neligh (drainage area 2,200 square miles) peaked at 14,500 cfs, recurrence interval about 40 years, on March 19, exceeding the June 1947 flood by about 2,500 cfs. Heavy rains, beginning March 30, combined with melting snow to cause flooding in much of New England with the worst floods occurring in Maine. A complete report will be given next month. Streamflow for the first half of the 1987 water year is shown by the map on page 14. Of the 191 stations reporting data for at least 5 of the 6 months, 28 (14.7 percent) had flows in the below-normal range, 99 (51.8 percent) had flows in the normal range, and 64 (33.5 percent) had flows in the above-normal range. (The persistence/change map in last month's issue was incomplete. The corrected map is shown on page 14.)

Average March elevations for the Great Lakes (provisional data from National Ocean Service) were lower than those for both last month and last March but continued to be above normal. Stage hydrographs for Lakes Superior, Huron, Erie, and Ontario are on page 5.

Utah's Great Salt Lake equaled last year's record high, 4,211.85 feet above National Geodetic Vertical Datum (NGVD) of 1929, on March 31 after rising 0.20 foot during the month. The graph of lake level from February 1, 1981, to March 31, 1986 (page 5), clearly shows the slow and small seasonal change in lake elevation for 1986–1987 in comparison to the more rapid and larger seasonal changes of the previous years. The National Weather Service (NWS) predicts a maximum lake elevation of 4,212.25 to 4,212.75 feet above NGVD of 1929 for late spring, given normal spring weather and an April 1 pump start-up for the West Desert Pumping Project. Pumping of water from the Great Salt Lake to an area in the western desert will eventually create a 500-square mile man-made lake averaging 2.5 feet deep, with the potential to evaporate about 850,000 acre feet per year (the approximate volume of the lake at full capacity), thus lowering the elevation of the Great Salt Lake.

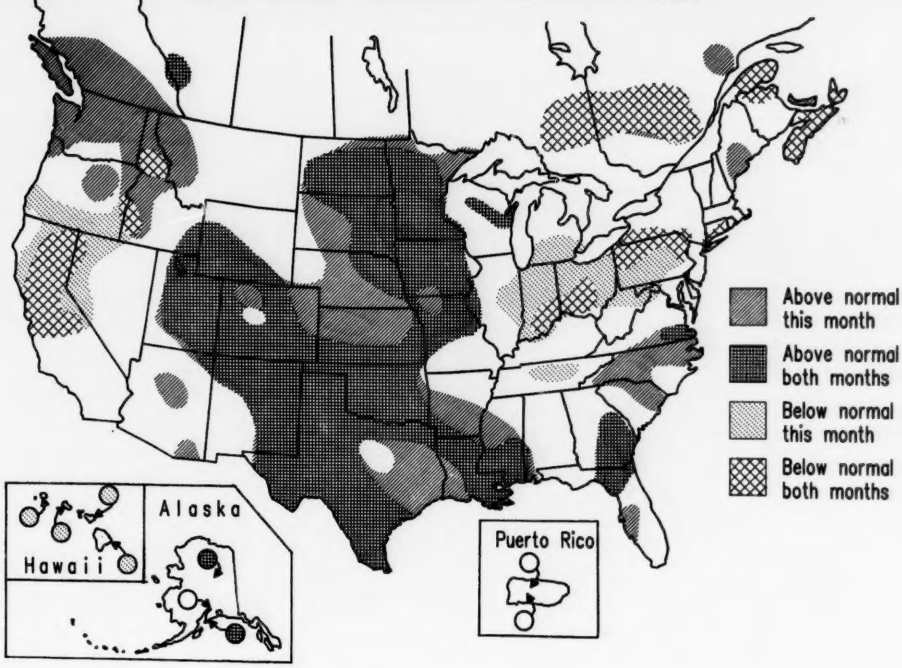
March precipitation (see maps on page 6) was generally an inch or more above average in: coastal Washington; an area centered on eastern Nebraska and extending into adjacent States on the north, east, and south; coastal Georgia and all of Florida, according to provisional data from the NWS. Precipitation was generally an inch or more below average in Hawaii, and also in much of the area extending from southeastern Texas northward to Wisconsin and eastward to the Appalachian Mountains. Total precipitation exceeded 6 inches in 23 cities, 10 of them in Florida, during the month. Maps of total winter (December 1986–February 1987) precipitation and percentage of normal winter precipitation are on page 7. Well-below normal amounts have fallen over much of the United States, particularly the Great Lakes basin and adjacent basins, and also the upper Missouri River, Columbia River, and Pacific Slope basins. Cumulative precipitation for the calendar year to date has also been less than 70 percent of normal in most of the Great Lakes basin and adjacent basins. Cumulative precipitaton for the calendar year has been less than 50 percent of normal at all four reporting cities in Hawaii, and also at several cities in Michigan and Minnesota. The March through May outlook maps for both temperature and precipitation are shown on page 15.

Contents of 87 percent of reporting reservoirs were near or above average for the end of March, compared with 83 percent for the end of February. Most reporting reservoirs in Georgia, Wisconsin, South Dakota, Oklahoma, Texas, Colorado, Nevada, Arizona, and New Mexico had contents significantly above average for the end of March. The only reservoirs or reservoir systems with both significant declines in contents during the month and significantly below-average contents for the end of the month were the six reservoirs reporting for Nova Scotia, Allard (Quebec), Narrows (North Carolina), and Ross and Chelan (Washington). Graphs of contents for seven reservoirs are shown on page 8 with contents for the 100 reporting reservoirs given on page 9.

The combined flow of the 3 largest rivers in the lower 48 States–Mississippi, St. Lawrence, and Columbia—averaged 1,441,500 cfs during March, 22.1 percent above median, and 46.6 percent above last month's flow. Flow hydrographs for both the combined and individual flows of the "Big 3" are shown on page 10. March flows of these three rivers are given in the Flow of Large Rivers table on page 11. Dissolved solids and water temperatures at five large river stations are given on page 10.

CONTENTS

PERSISTENCE IN, OR MOVEMENT INTO, THE BELOW-NORMAL OR ABOVE-NORMAL FLOW RANGE: FEBRUARY TO MARCH 1987



SUMMARY OF MARCH 1987 STREAMFLOW

[Flow ranges]

Area	Below normal range		Normal range		Above normal range		Number of stations	
	No.	Percent	No.	Percent	No.	Percent	Reporting data	Missing data
Conterminous United States.	30	18.4	78	47.9	55	33.7	163	0
Alaska, Hawaii, and Puerto Rico.	4	40.0	3	30.0	3	30.0	10	0
United States and Puerto Rico.	34	19.7	81	46.8	58	33.5	173	0
Southern Canada........	8	47.0	7	41.2	2	11.8	17	*1
Conterminous United States and southern Canada.	38	21.1	85	47.2	57	31.7	180	*1
All sites..................	42	22.1	88	46.3	60	31.6	190	*1

*Qu'Appelle at Lumsden, Saskatchewan, Canada.

[Comparison of total monthly means with total monthly medians and last month's total monthly means]

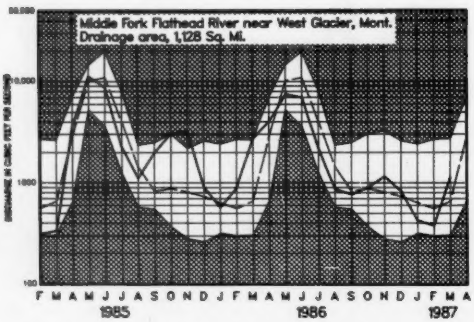
Total of March means (190 sites)...	2,815,680 CFS
Total of March medians (190 sites)...	2,537,190 CFS
Total of last month's means (190 sites)...	*2,032,130 CFS
Total of March means compared to total of medians...	+11.0 Percent
Total of March means compared to total of last month's means............................	+42.9 Percent

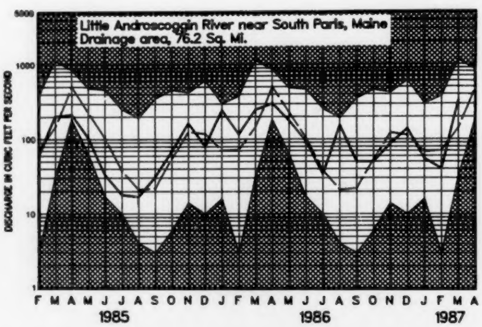
*Revised.

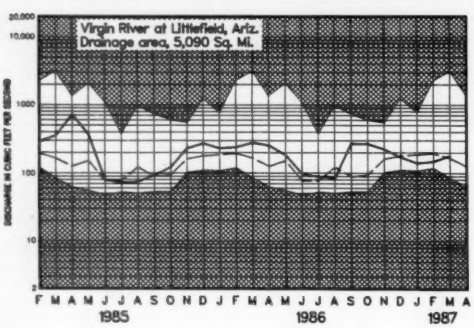
NEW MAXIMUMS DURING MARCH 1987 AT STREAMFLOW INDEX STATIONS

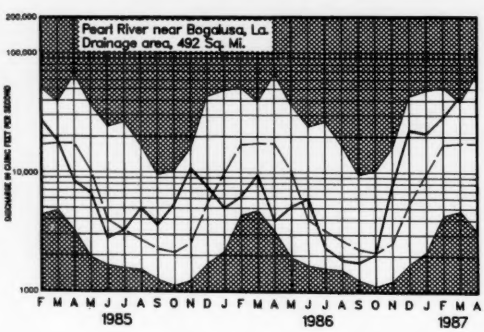
Station number	Stream and place of determination	Drainage area (square miles)	Years of record	Previous March maximums (period of record): Monthly mean in cfs (year)	Previous March maximums (period of record): Daily mean in cfs (year)	March 1987: Monthly mean in cfs	March 1987: Percent of median	March 1987: Daily mean in cfs	March 1987: Day
02489500	Pearl River near Bogalusa, La.	6,573	48	38,920 (1979)	104,000 (1980)	43,590	249	66,800	4
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, N.Y.	298,800	126	301,600 (1974)	321,000 (1978)	314,000	126	338,000	4
07331000	Washita River near Dickson, Okla.	7,202	58	9,384 (1945)	44,300 (1945)	10,700	1,804	25,800	2
08276500	Rio Grande below Taos Junction Bridge, near Taos, N. Mex.	9,730	61	1,151 (1939)	2,270 (1939)	1,214	213	1,430	*
08408500	Delaware River near Red Bluff, N. Mex.	689	50	6.7 (1942)	23.0 (1957)	9.40	470	9.90	*

* Occurred more than once.



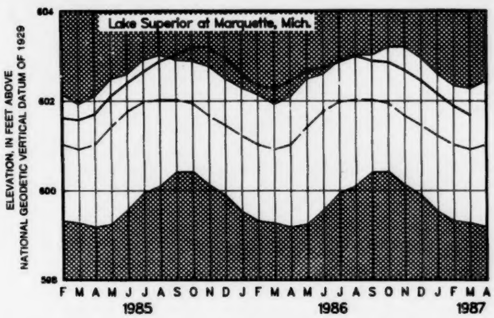


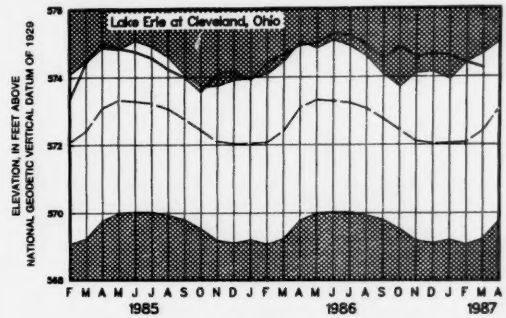


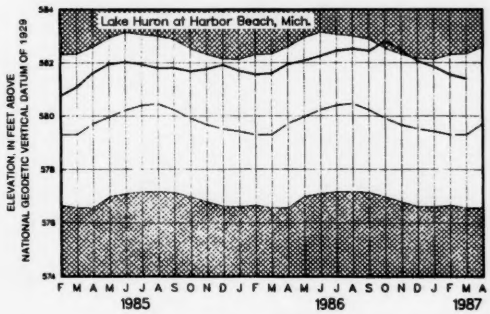


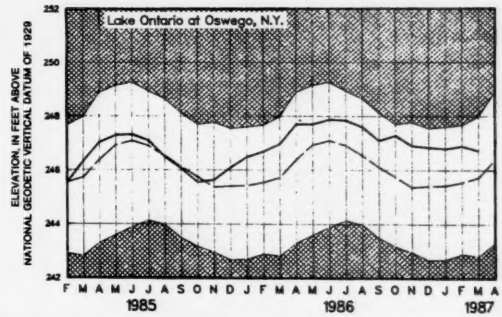
GREAT LAKES ELEVATIONS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.

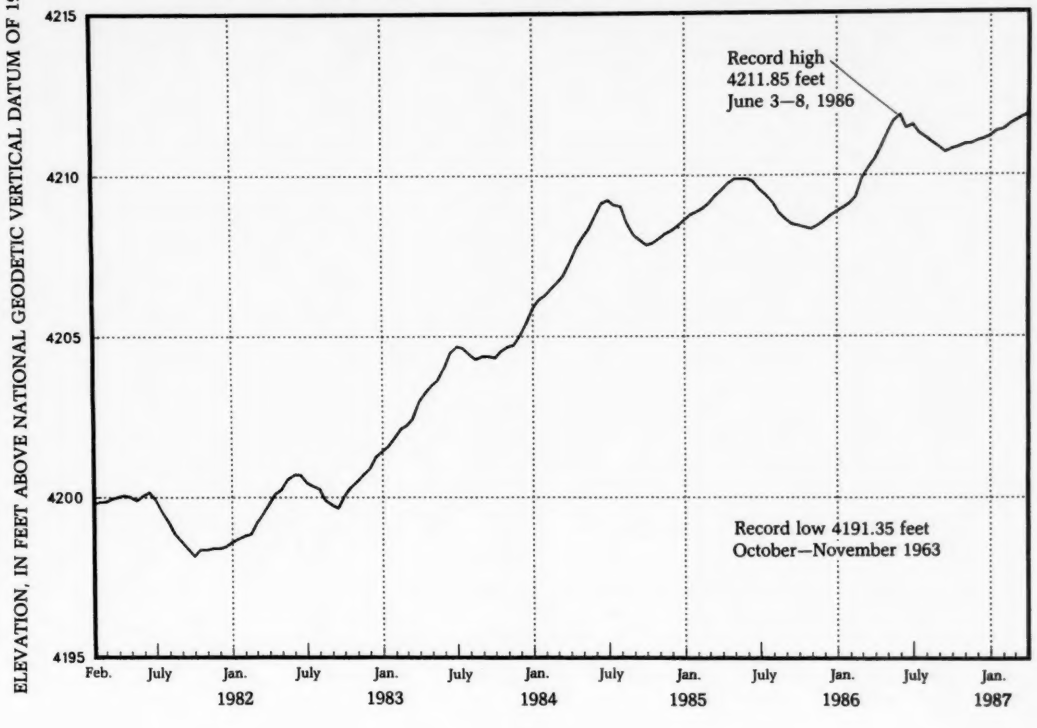


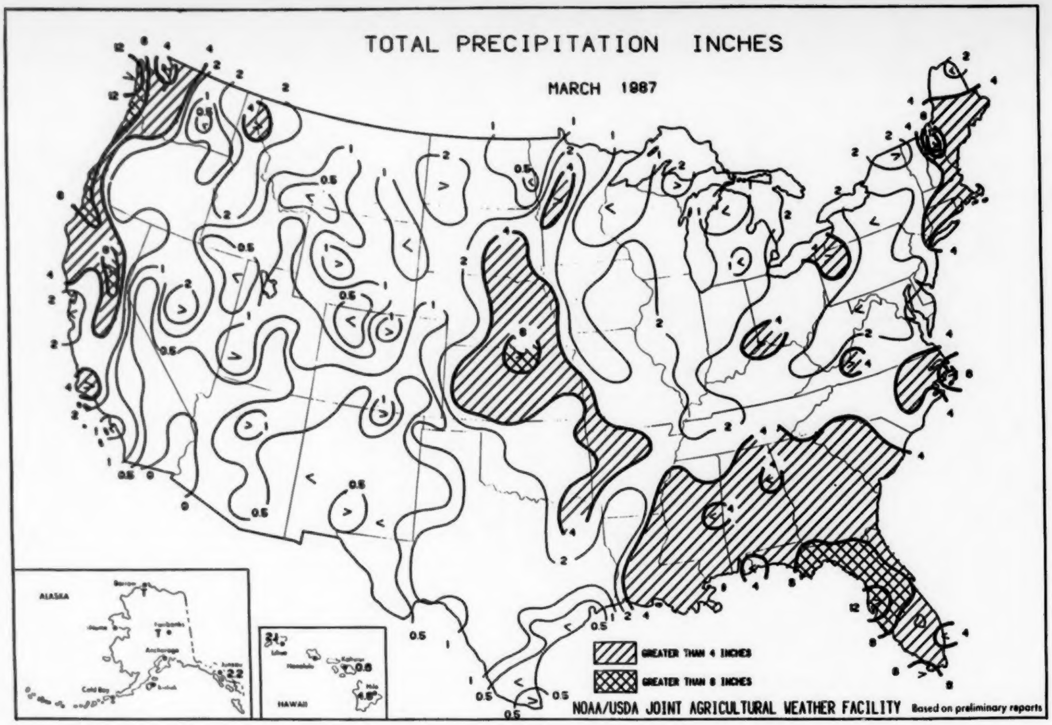


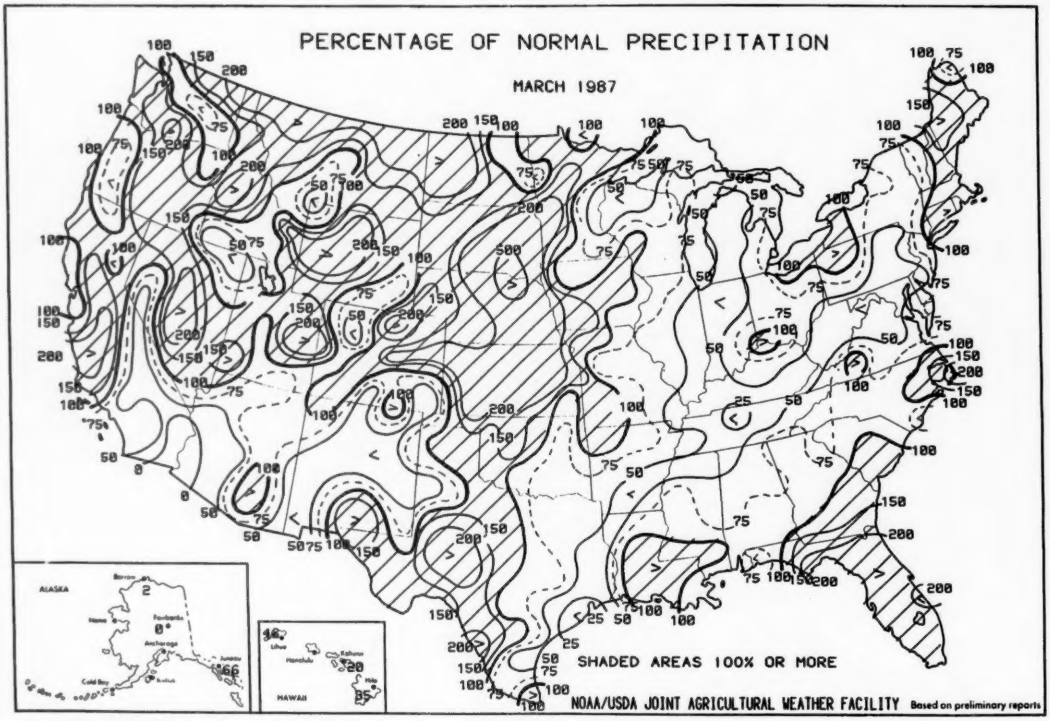




Fluctuations of Great Salt Lake, February 1981 to April 1987

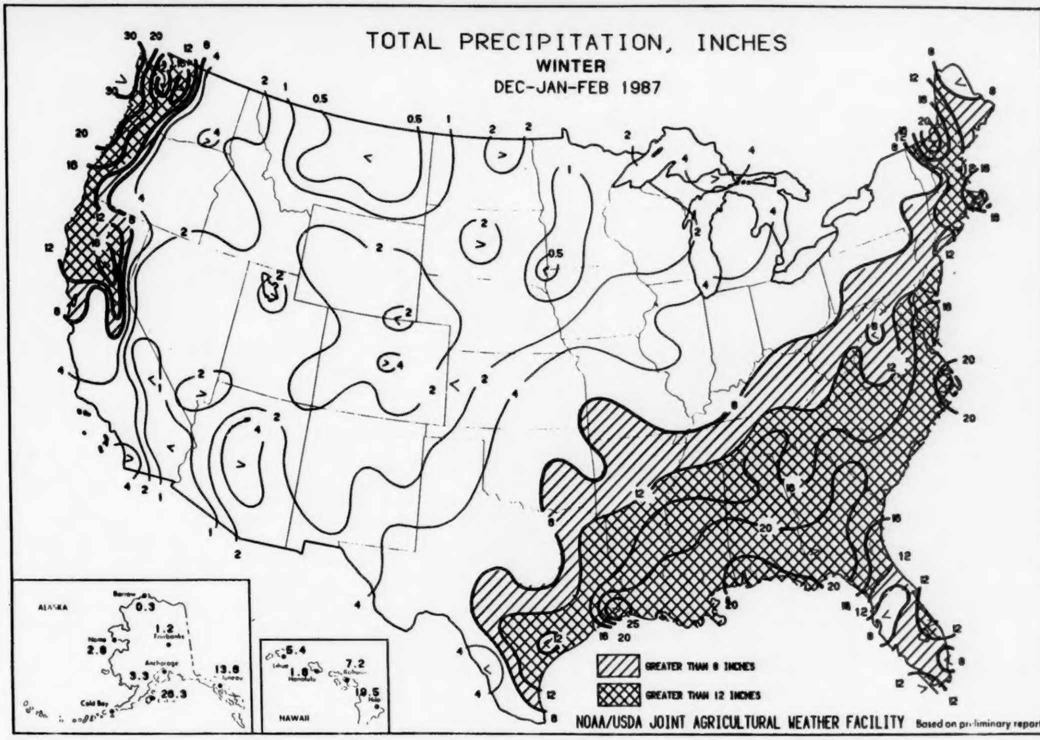


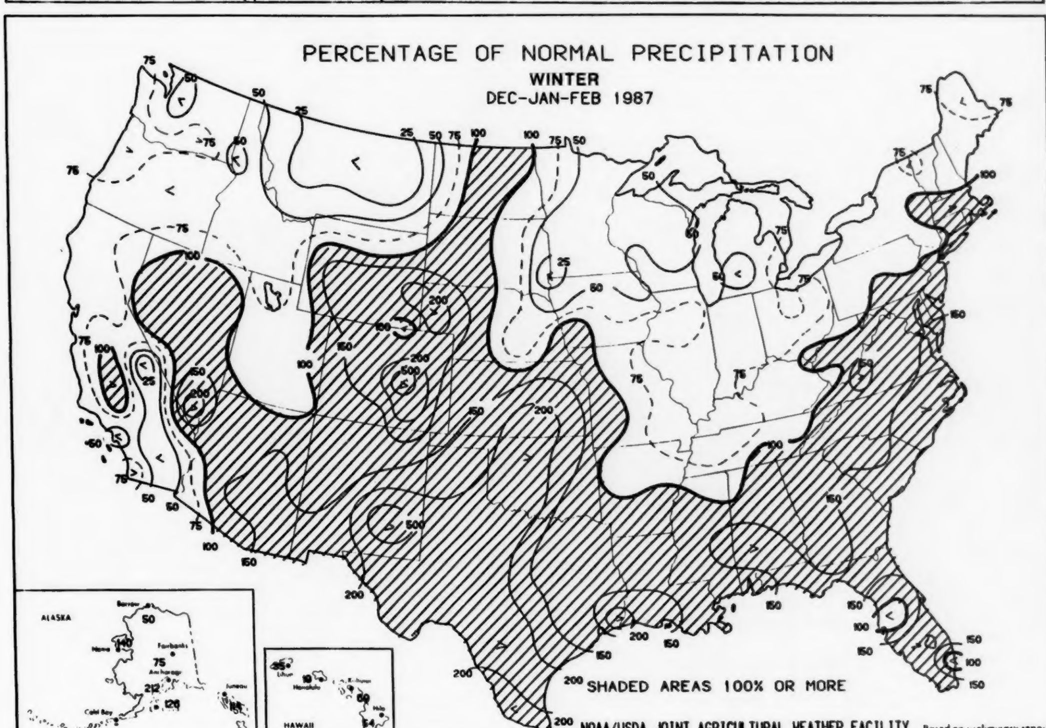




(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

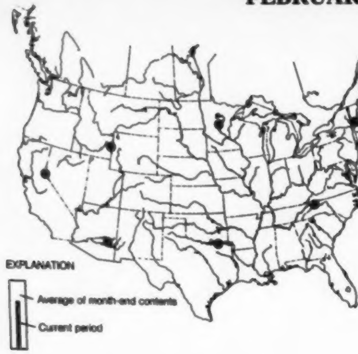
WINTER PRECIPITATION

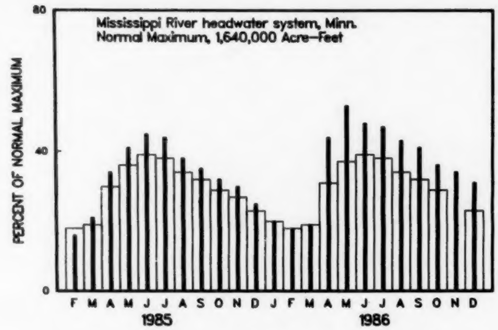


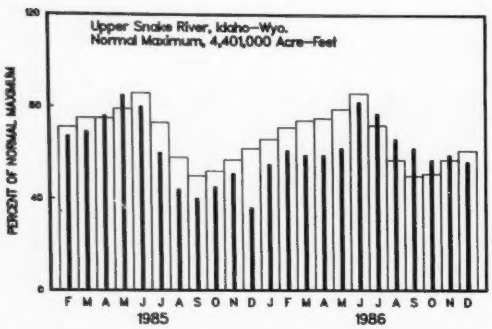


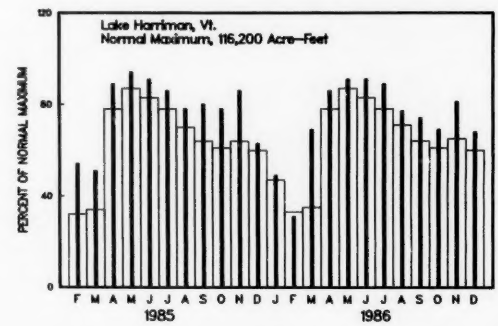
(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

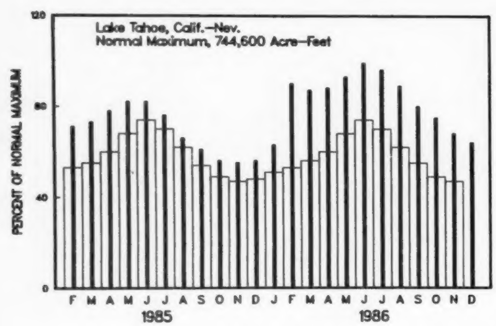
USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS
FEBRUARY 1987 TO MARCH 1987

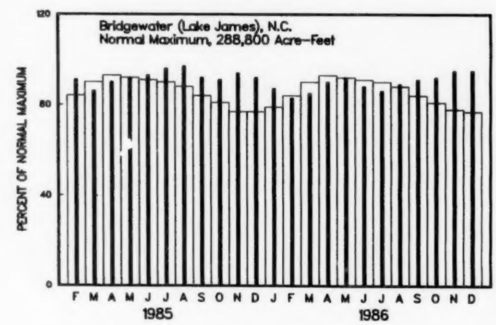


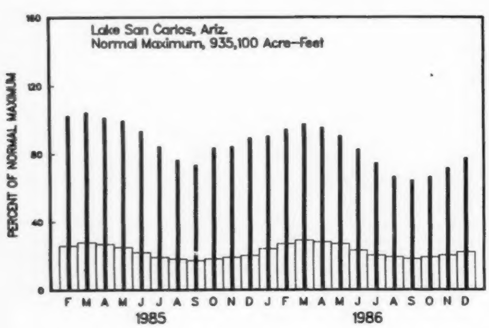


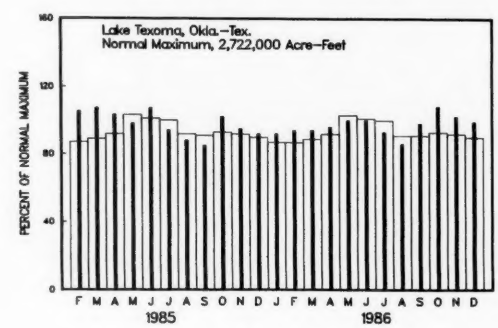












USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF MARCH 1987

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

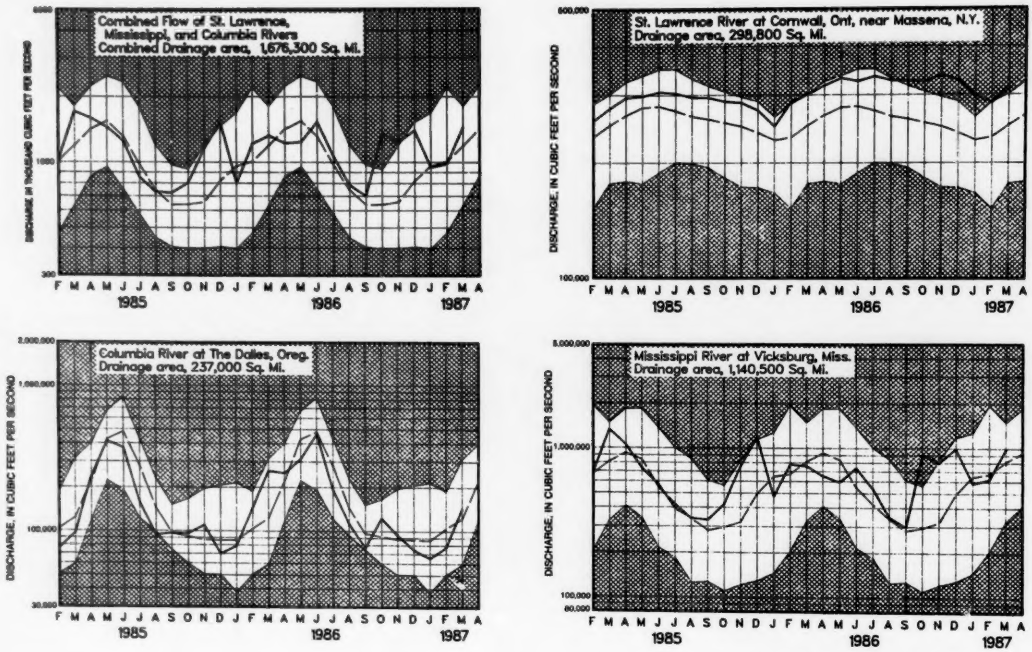
Reservoir Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial	Percent of normal maximum				Normal maximum[a] (acre-feet)
	End of Mar. 1987	End of Mar. 1986	Average for end of Mar.	End of Feb. 1987	
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs(P)	22	30	64	35	[b]226,300
QUEBEC					
Allard (P)	11	25	32	27	280,600
Gouin (P)	68	52	48	65	6,954,000
MAINE					
Seven reservoir systems (MP)	33	50	36	29	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	27	57	17	29	76,450
Lake Francis (FPR)	28	27	22	26	99,310
Lake Winnipesaukee (PR)	61	72	66	44	165,700
VERMONT					
Harriman (P)	33	69	35	25	116,200
Somerset (P)	42	62	52	45	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	84	85	78	72	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	48	67	48	29	786,700
Indian Lake (FMP)	56	89	49	57	103,300
New York City reservoir system (MW)	95	100	96	83	1,680,000
NEW JERSEY					
Wanaque (M)	100	101	89	90	85,100
PENNSYLVANIA					
Allegheny (FPR)	40	40	35	28	1,180,000
Pymatuning (FMR)	80	93	94	72	188,000
Raystown Lake (FR)	68	68	58	68	761,900
Lake Wallenpaupack (PR)	59	62	64	49	157,800
MARYLAND					
Baltimore municipal system (M)	81	82	92	74	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	95	85	90	90	288,800
Narrows (Badin Lake) (P)	93	92	100	100	128,900
High Rock Lake (P)	93	51	81	83	234,800
SOUTH CAROLINA					
Lake Murray (P)	93	89	79	86	1,614,000
Lakes Marion and Moultrie (P)	86	87	81	69	1,862,000
SOUTH CAROLINA—GEORGIA					
Clark Hill (FP)	77	62	74	75	1,730,000
GEORGIA					
Burton (PR)	89	84	82	82	104,000
Sinclair (MPR)	99	86	89	100	214,000
Lake Sidney Lanier (FMPR)	63	52	60	52	1,686,000
ALABAMA					
Lake Martin (P)	93	91	89	82	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	53	49	52	41	2,293,000
Douglas Lake (FPR)	35	32	42	23	1,394,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	62	55	64	52	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	64	55	56	46	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	62	48	63	47	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	68	48	28	59	365,000
Wisconsin River (21 reservoirs) (PR)	34	39	26	25	399,000
MINNESOTA					
Mississippi River headwater system (FMR)	30	19	19	22	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	85	80	82	84	22,700,000
SOUTH DAKOTA					
Angostura (I)	95	76	82	94	127,600
Belle Fourche (I)	87	52	63	74	185,200
Lake Francis Case (FIP)	88	77	81	72	4,834,000
Lake Oahe (FIP)	91	91	...	83	22,530,000
Lake Sharpe (FIP)	100	101	99	100	1,725,000
Lewis and Clark Lake (FIP)	78	75	83	78	432,000

Reservoir Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial	Percent of normal maximum				Normal maximum[a] (acre-feet)
	End of Mar. 1987	End of Mar. 1986	Average for end of Mar.	End of Feb. 1987	
NEBRASKA					
Lake McConaughy (IP)	81	82	77	82	1,948,000
OKLAHOMA					
Eufaula (FRP)	110	91	89	102	2,378,000
Keystone (FPR)	105	84	99	109	661,000
Tenkiller Ferry (FPR)	113	105	94	106	628,200
Lake Altus (FIMR)	100	24	52	101	133,000
Lake O'The Cherokees (FPR)	103	88	88	112	1,492,000
OKLAHOMA—TEXAS					
Lake Texoma (FMPRW)	101	94	89	100	2,722,000
TEXAS					
Bridgeport (IMW)	100	78	48	97	386,400
Canyon (FMR)	103	97	79	99	385,600
International Amistad (FIMPW)	85	63	82	84	3,497,000
International Falcon (FIMPW)	86	33	72	79	2,668,000
Livingston (IMW)	104	99	89	103	1,788,000
Possum Kingdom (IMPRW)	97	87	94	97	570,200
Red Bluff (PI)	91	21	29	87	307,000
Toledo Bend (P)	98	90	87	94	4,472,000
Twin Buttes (FIM)	62	12	30	55	177,800
Lake Kemp (IMW)	102	91	85	101	268,000
Lake Meredith (FWM)	29	30	37	29	796,900
Lake Travis (FIMPRW)	99	100	82	99	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	77	73	75	76	2,043,000
Fort Peck (FPR)	84	75	82	84	18,910,000
Hungry Horse (FIPR)	68	73	59	67	3,451,000
WASHINGTON					
Ross (PR)	19	52	30	31	1,052,000
Franklin D. Roosevelt Lake (IP)	94	92	50	94	5,022,000
Lake Chelan (PR)	19	45	31	25	676,100
Lake Cushman (PR)	78	95	84	55	359,500
Lake Merwin (P)	100	97	98	99	245,600
IDAHO					
Boise River (4 reservoirs) (FIP)	75	74	66	67	1,235,000
Coeur d'Alene Lake (P)	59	88	72	32	238,500
Pend Oreille Lake (FP)	51	51	51	35	1,561,000
IDAHO—WYOMING					
Upper Snake River (8 reservoirs) (MP)	79	59	74	66	4,401,000
WYOMING					
Boysen (FIP)	72	69	64	74	802,000
Buffalo Bill (IP)	65	70	60	65	421,300
Keyhole (F)	44	33	46	36	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	75	68	52	71	3,056,000
COLORADO					
John Martin (FIR)	97	97	22	92	364,400
Taylor Park (IR)	62	62	55	71	106,200
Colorado-Big Thompson project (I)	82	82	57	82	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	83	84	...	83	31,620,000
UTAH—IDAHO					
Bear Lake (IPR)	79	79	60	74	1,421,000
CALIFORNIA					
Folsom (FIP)	65	64	63	54	1,000,000
Hetch Hetchy (MP)	34	70	29	34	360,400
Isabella (FIR)	42	72	32	43	568,100
Pine Flat (FI)	61	85	59	64	1,001,000
Clair Engle Lake (Lewiston) (P)	85	88	83	77	2,438,000
Lake Almanor (P)	83	97	56	77	1,036,000
Lake Berryessa (FIMW)	87	101	90	85	1,600,000
Millerton Lake (FI)	40	79	67	31	503,200
Shasta Lake (FIPR)	94	82	84	77	4,377,000
CALIFORNIA—NEVADA					
Lake Tahoe (IPR)	67	87	56	66	744,600
NEVADA					
Rye Patch (I)	84	91	70	75	194,300
ARIZONA—NEVADA					
Lake Mead and Lake Mohave (FIMP)	93	89	68	94	27,970,000
ARIZONA					
San Carlos (IP)	84	97	30	80	935,100
Salt and Verde River system (IMPR)	101	98	53	86	2,019,100
NEW MEXICO					
Conchas (FIR)	100	86	79	101	330,100
Elephant Butte and Caballo (FIPR)	95	96	34	96	2,442,000

[a] 1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second day.
[b] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR MARCH 1987, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

Station number	Station name	March data of following calendar years	Stream discharge during month	Dissolved-solids concentration[a]		Dissolved-solids discharge[a]			Water temperature[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum	Maximum	Mean in °C	Minimum, in °C	Maximum, in °C
						(tons per day)					
01463500	Delaware River at Trenton, NJ	1987	*15,710	79	118	3,500	2,490	5,830	7.0	3.0	12.0
	(Morrisville, PA).	1945–86	20,360	44	136	....	1,100	98,100	...	0	15.0
		(Extreme yr)		(1945)	(1980)		(1980)				
			[c]20,040								
07289000	Mississippi River at	1987	984,100	206	262	590,940	488,900	706,380	11.0	8.0	14.5
	Vicksburg, MS.	1976–86	900,900	166	257	503,200	180,000	803,000	9.5	5.0	14.5
		(Extreme yr)		(1979)	(1986)		(1981)	(1979)			
			[c]814,500								
03612500	Ohio River at lock and dam 53,	1987	385,000	171	222	....	106,000	408,000	...	7.5	9.5
	near Grand Chain, IL (stream-	1955–86	534,500	128	312	....	50,000	776,000	...	0.5	14.5
	flow station at Metropolis, IL).	(Extreme yr)		(1955,	(1968)		(1986)	(1979)			
			[c]578,300	1964)							
06934500	Missouri River at Hermann,	1987	146,000	287	406	133,000	90,200	198,000	11.0	6.5	16.0
	MO (60 miles west of	1976–86	112,800	186	530	92,550	29,300	199,000	7.5	0	15.0
	St. Louis, MO).	(Extreme yr)		(1978)	(1981)		(1977)	(1979,			
			[c]74,200					1984)			
14128910	Columbia River at Warrendale,	1987	143,400	102	122	40,500	32,400	50,900	6.0	5.0	7.5
	OR (streamflow station at	1976–86	209,600	87	136	60,300	25,600	114,300	6.0	3.0	8.0
	The Dalles, OR).	(Extreme yr)		(1980,	(1986)		(1980)	(1983)			
				1986)							
			[c]123,000								

[a]Dissolved-solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951—80, for comparison with data for current month.
*Dissolved-solids and water-temperature records are for 24 days only (March 1-8,16-31).

FLOW OF LARGE RIVERS DURING MARCH 1987

Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1980 (cubic feet per second)	March 1987: Monthly mean discharge (cubic feet per second)	March 1987: Percent of median monthly discharge, 1951—80	March 1987: Change in discharge from previous month (percent)	March 1987: Discharge near end of month: Cubic feet per second	March 1987: Discharge near end of month: Million gallons per day	March 1987: Discharge near end of month: Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,690	9,647	3,294	136	+143	30,000	19,000	31
01318500	Hudson River at Hadley, N.Y.	1,664	2,909	3,530	118	+167	15,000	9,700	31
01357500	Mohawk River at Cohoes, N.Y.	3,456	5,734	11,300	106	+357	20,500	13,250	31
01463500	Delaware River at Trenton, N.J.	6,780	11,750	15,710	78	+147	15,900	10,280	31
01570500	Susquehanna River at Harrisburg, Pa.	24,100	34,530	50,200	70	+70	30,700	19,840	26
01646500	Potomac River near Washington, D.C.	11,560	[1]11,490	[1]16,800	69	+25	7,850	5,073	31
02105500	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	5,005	8,000	79	+0	5,696	3,681	31
02131000	Pee Dee River at Peedee, S.C.	8,830	9,851	32,600	181	+143	16,600	10,730	31
02226000	Altamaha River at Doctortown, Ga.	13,600	13,880	39,460	125	−6	23,100	14,930	27
02320500	Suwannee River at Branford, Fl.	7,880	6,987	25,400	226	+5	21,800	14,090	28
02358000	Apalachicola River at Chattahoochee, Fl.	17,200	22,570	45,900	111	+24	27,460	17,747	31
02467000	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	23,300	69,250	145	+56	33,600	21,720	31
02489500	Pearl River near Bogalusa, La.	6,630	9,768	43,590	249	+50	12,600	8,140	31
03049500	Allegheny River at Natrona, Pa.	11,410	[1]19,480	[1]21,040	52	+110	10,400	6,720	25
03085000	Monongahela River at Braddock, Pa.	7,337	[1]12,510	[1]9,795	46	−38	7,900	5,110	25
03193000	Kanawha River at Kanawha Falls, W.Va.	8,367	12,590	29,580	124	+62	14,600	9,440	26
03234500	Scioto River at Higby, Ohio	5,131	4,547	1,863	19	+9	4,400	2,840	31
03294500	Ohio River at Louisville, Ky.[2]	91,170	11,600	156,500	63	+13	107,900	69,740	30
03377500	Wabash River at Mount Carmel, Ill.	28,635	27,220	23,420	41	+28	16,600	10,730	25
03469000	French Broad River below Douglas Dam, Tenn.	4,543	6,798	12,290	105	+63	...	...	..
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,163	3,874	91	−31	2,809	1,815	31
04264331	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	298,800	242,700	314,000	126	+10	270,000	175,000	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	25,150	5,860	70	+307	30,200	19,520	31
05082500	Red River of the North at Grand Forks, N.Dak.	30,100	2,551	8,129	436	+401	16,300	10,530	30
05133500	Rainy River at Manitou Rapids, Minn.	19,400	11,830	9,000	93	+14	12,000	7,800	27
05330000	Minnesota River near Jordan, Minn.	16,200	3,402	3,653	115	+93	6,100	3,940	31
05331000	Mississippi River at St. Paul, Minn.	36,800	[1]10,610	12,480	161	+43	22,000	14,200	31
05365500	Chippewa River at Chippewa Falls, Wis.	5,600	5,100	4,085	87	+97	5,200	3,360	29
05407000	Wisconsin River at Muscoda, Wis.	10,300	8,617	8,911	93	+22	10,500	6,790	31
05446500	Rock River near Joslin, Ill.	9,551	5,873	6,420	69	+6	7,210	4,659	31
05474500	Mississippi River at Keokuk, Iowa	119,000	62,620	68,700	82	+32	87,900	56,810	31
06214500	Yellowstone River at Billings, Mont.	11,796	7,038	2,660	86	−3	2,650	1,712	31
06934500	Missouri River at Hermann, Mo.	524,200	79,490	146,400	197	+91	204,000	131,800	31
07289000	Mississippi River at Vicksburg, Miss.[4]	1,140,500	576,600	984,100	121	+59	841,000	543,500	27
07331000	Washita River near Dickson, Okla.	7,202	1,368	10,700	1,804	+130	9,000	5,800	31
08276500	Rio Grande below Taos Junction Bridge, near Taos, N.Mex.	9,730	725	1,214	213	+40	1,430	924	31
09315000	Green River at Green River, Utah	44,850	6,298	5,297	131	−5	4,970	3,140	24
11425500	Sacramento River at Verona, Calif.	21,257	18,820	20,100	64	+25	11,700	7,560	31
13269000	Snake River at Weiser, Idaho	69,200	18,050	13,800	70	−4	14,000	9,000	31
13317000	Salmon River at White Bird, Idaho	13,550	11,250	5,110	101	+25	4,190	2,708	31
13342500	Clearwater River at Spalding, Idaho	9,570	15,480	8,780	68	+77	5,720	3,696	31
14105700	Columbia River at The Dalles, Oreg.[5]	237,000	[1]193,100	[1]143,400	117	+85	144,900	93,650	30
14191000	Willamette River at Salem, Oreg.	7,280	[1]23,510	[1]28,100	85	−39	14,000	9,000	30
15515500	Tanana River at Nenana, Alaska	25,600	23,460	6,729	109	−7	6,600	4,270	31
08MF005	Fraser River at Hope, British Columbia.	83,800	96,290	45,550	142	+36	44,490	28,760	30

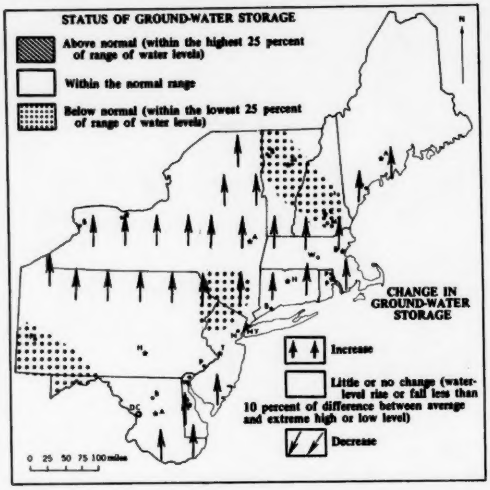
[1]Adjusted.
[2]Records furnished by Corps of Engineers.
[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

GROUND-WATER CONDITIONS DURING MARCH 1987

Ground-water levels rose in much of the region, especially in most of Connecticut, Massachusetts, Delaware, and New York State. (See map.) Levels declined, at least slightly, in scattered parts of Maryland, southern Pennsylvania, northern New Jersey, southern Rhode Island, northern Maine, New Hampshire, and Vermont. Ground-water levels near the end of March were generally in the normal range but there were three areas of below-average levels encompassing parts of New Hampshire, Vermont, New York, New Jersey, Pennsylvania, and Maryland.

In the Southeastern States, ground-water levels rose in Arkansas and Mississippi. Net water-level changes during the month were mixed in West Virginia, Kentucky, Virginia, North Carolina, Louisiana, and Georgia. Water levels were above average in Kentucky, below average in Arkansas and Louisiana, and mixed with respect to average in West Virginia, Virginia, and North Carolina. Despite net rises in levels during the month, new low levels for March were established in key wells at Memphis, Tennessee, and at Stuttgart, Arkansas. In the Tennessee well, this is the latest in an extended series of new monthend low levels. The new low in Arkansas is the third consecutive monthend low level in the Stuttgart well.

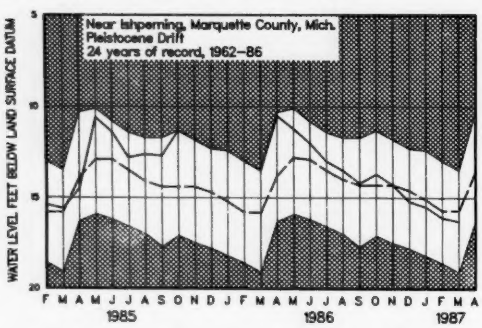
In the central and western Great Lakes States, ground-water levels rose in Iowa, and declined in Wisconsin and Indiana. Levels showed mixed changes in Minnesota, Michigan, and Ohio. Water levels were above average in Iowa, near or above average in Wisconsin, and below average in Michigan and Ohio. Levels were mixed with respect to average in Minnesota.

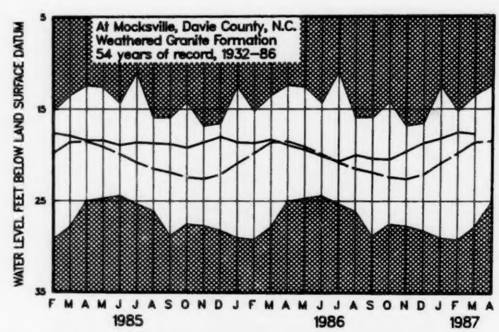


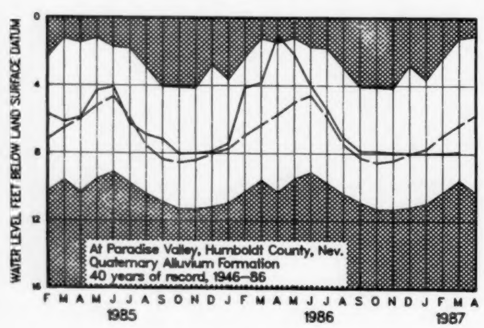
Map showing ground-water storage near end of March and change in ground-water storage from end of February to end of March.

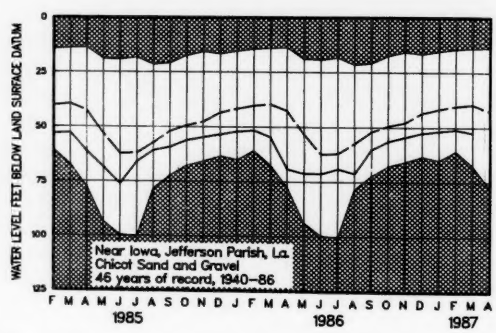
MONTH-END GROUND-WATER LEVELS IN KEY WELLS

Unshaded area indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.









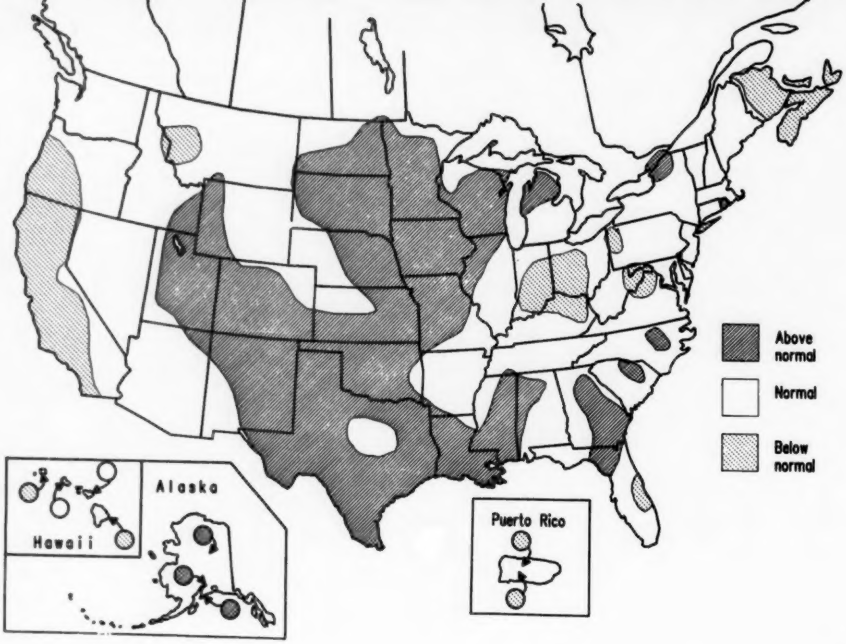
In the Western States, ground-water levels rose in Washington, Nebraska, Kansas, Arizona, and Texas. Levels declined in Idaho and Utah. Net changes in level were mixed in southern California, Nevada, and New Mexico. Water levels were above long-term averages in Washington, North Dakota, and Nebraska. Levels were mixed with respect to average in other Western States. New high ground-water levels for March were recorded in the Ashland key well in Nebraska and, despite a net decline during the month, in the Berrendo-Smith well in the Roswell artesian basin in New Mexico. New March low levels occurred in the Las Vegas Valley well in Nevada and, despite net rises during the month, in the Dayton key well in the southern Roswell basin in New Mexico and in the El Paso observation well in western Texas. Despite net declines in water levels during the month, all-time high ground-water levels were reached in key wells in Ewing, Nebraska, in 52 years of record, and in the Steptoe Valley, Nevada, in 37 years of record.

Provisional data; subject to revision

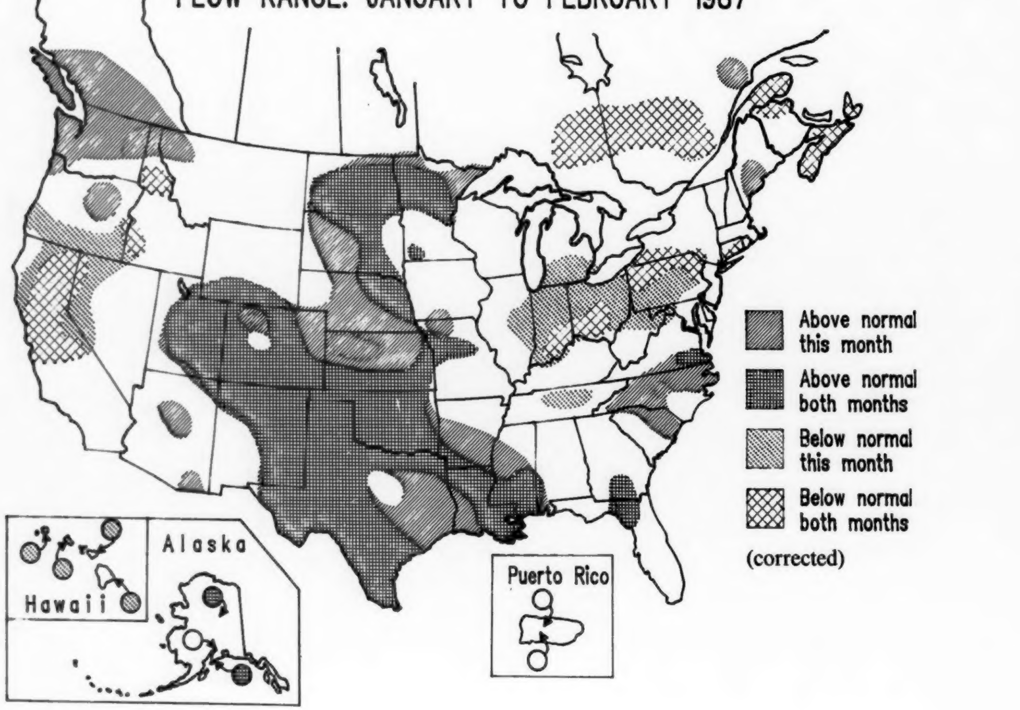
WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES—MARCH 1987

Aquifer and Location	Water level in feet with reference to land-surface datum	Departure from average in feet	Net change in water level in feet since:		Year records began	Remarks
			Last month	Last year		
Glacial drift at Hanska, south-central Minnesota.	−7.10	−0.16	−0.28	−2.56	1942	
Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan.	−4.68	−0.17	+0.13	−0.89	1935	
Glacial drift at Marion, Iowa	−2.53	+1.43	+2.07	−0.57	1941	
Glacial drift at Princeton in northwestern Illinois.	−7.98	+1.66	+0.37	−1.23	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	−13.10	+1.18	−0.41	+0.62	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	−18.69	+6.47	−0.06	−1.22	1946	
500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	−105.29	−16.26	+0.15	−0.91	1941	March low.
Granite in eastern Piedmont Province, Chapel Hill, North Carolina (U.S. well no. 5).	−43.37	−1.33	+1.52	−1.55	1931	
Sparta Sand in Pine Bluff industrial area, Arkansas.	−229.95	−23.17	+0.50	−11.95	1958	
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	−21.6	−3.4	+1.2	−0.9	1952	
Limestone aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	−30.79	−5.21	+0.49	+1.79	1956	
Sand and gravel in Puget Trough, Tacoma, Washington.	−100.48	+6.63	+0.18	+0.16	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	−465.4	−3.8	−0.1	−3.2	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	−122.4	−1.2	−1.0	+0.2	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	−7.04	+17.10	−0.32	−2.90	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	+0.03	+4.61	+3.78	+3.95	1935	March high.
Alluvial valley fill in Steptoe Valley, Nevada	−6.51	+5.89	+0.38	+0.36	1950	All-time high.
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	−16.42	+4.64	+1.10	+1.78	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria Valley, California	−167.89	+28.49	+35.59	−29.74	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	−102.4	−22.7	+0.2	+1.6	1951	
Hueco bolson, El Paso area, Texas	−264.77	−17.76	+0.02	−0.77	1965	March low.
Evangeline aquifer, Houston area, Texas	−310.81	−15.11	+1.85	−4.29	1965	

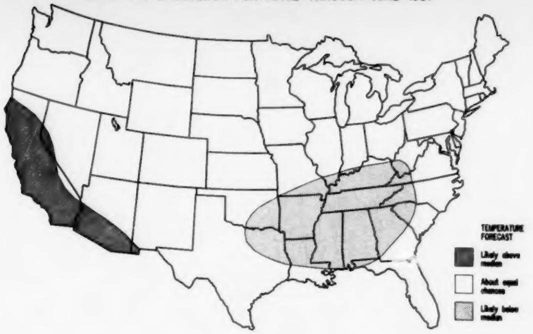
STREAMFLOW FOR THE FIRST HALF OF THE 1987 WATER YEAR
October 1, 1986–March 31, 1987 (FALL-WINTER)



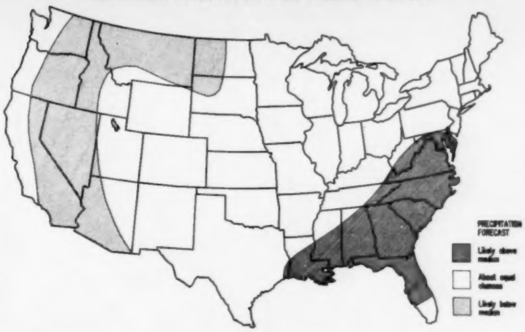
PERSISTENCE IN, OR MOVEMENT INTO, THE BELOW-NORMAL OR ABOVE-NORMAL FLOW RANGE: JANUARY TO FEBRUARY 1987



TEMPERATURE OUTLOOK FOR APRIL THROUGH JUNE 1987



PRECIPITATION OUTLOOK FOR APRIL THROUGH JUNE 1987



NATIONAL WATER CONDITIONS

MARCH 1987

Based on reports from the Canadian and U.S. Field offices; completed April 16, 1987

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EXPLANATION OF DATA (Revised April 1987)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 183 index gaging stations—18 in Canada, 163 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, one New York index station, and the Puerto Rico index stations because of the limited records available.

The *persistence/change* map shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. The table below the map shows areal streamflow range conditions for all index stations reporting data for this month and compares total flow of the stations reporting data for both last month and this month.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range) 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as; *above normal* if it is greater than the upper quartile, *in the normal range* if it is between the upper and lower quartiles, and *below normal* if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as *seasonal* if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as *contraseasonal* (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. *Probability of occurrence* is the chance that a given flood magnitude will be exceeded in any one year. *Recurrence interval* is the reciprocal of probability of occurrence and is the *average* number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. *Recurrence intervals imply no regularity of occurrence;* a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about *ground-water levels* refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. *Changes in ground-water levels,* unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data for March are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). *Dissolved solids* are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. *Dissloved-solids discharge* represents the total daily amount of dissolved minerals carried by the stream. *Dissolved-solids concentrations* are generally higher during periods of low streamflow, but the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

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